Edouard Garcia
Attorney At Law

FACSIMILE COVER PAGE

To: David Payne	From: Edouard Garcia
Fax #: +1 (571) 2738300	Fax #: 877-208-8709
Company: U.S. Patent & Trademark Office	Tel #: 650-289-0904

Subject: U.S. Application No. 09/818,433, Filed March 26, 2001	
Sent: 3/1/2006 at 5:55:34 PM	Pages: 28 (including cover)

MESSAGE:

Applicant	:	Michael A. Robinson et al.
Serial No.	:	09/818,433
Filed	:	March 26, 2001
Art Unit	:	2633
Examiner	:	Payne, David C.
Title	:	FIBER OPTIC RECEIVER WITH AN ADJUSTABLE BANDWIDTH □ POST-AMPLIFIER

544 Emerald Avenue, San Carlos, CA 94070

Attorney's Docket No.: 10003782-2

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Michael A. Robinson et al. Art Unit : 2633
Serial No. : 09/818,433 Examiner : Payne, David C.
Filed : March 26, 2001
Title : FIBER OPTIC RECEIVER WITH AN ADJUSTABLE BANDWIDTH POST-AMPLIFIER

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

PETITION UNDER 37 CFR § 1.10(e)

Applicant hereby petitions the director under 37 CFR § 1.10(e) to consider an Information Disclosure Statement ("the IDS"; a copy of which is attached hereto as Exhibit A) as having been timely filed on March 26, 2001, for the reasons explained below.

1. On March 1, 2006, Examiner David Payne notified the undersigned that the U.S. Patent and Trademark Office (the "Office") has no record of having received the IDS.

2. In response to Examiner Payne's notification, the undersigned promptly filed this Petition.

3. On March 26, 2001, a correspondence (the "correspondence) was deposited with the United States Postal Service in accordance with 37 CFR § 1.10(a) in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231.

4. A copy of the correspondence, without the signed Declaration (which is missing from the application file of Avago Technologies, Inc.), is attached hereto as Exhibit B. For the convenience of the Office, the top margins of the pages of Exhibit B have been numbered sequentially. A copy of the IDS appears on pages 17 and 18 of Exhibit B. Copies of the headers of the U.S. Patent documents that are listed in the IDS appear on page 19 of Exhibit B. The Express Mail certifications on the Application Transmittal Letter on page 1 of Exhibit B and on the IDS Transmittal Letter on page 18 of Exhibit B indicate that the IDS

CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that this correspondence is being facsimile transmitted to the Patent and Trademark Office fax phone number 571-273-8300 on the date shown below:

March 1, 2006
Date

(Signature of person mailing papers)

Edouard Garcia
(Typed or printed name of person mailing papers)

was being filed with the application on March 26, 2001, in accordance with the Express Mail Post Office to Addressee service of the U.S. Postal Service.

5. A copy of the postcard that was filed with the correspondence and returned by the Office is attached hereto as Exhibit C. The returned postcard indicates that the correspondence included:

- an IDS with 7 references
- 11 pages of specification, claims, & abstract
- 12 Claims (total #)
- 3 Sheets of Drawings
- a signed Declaration and Power of Attorney
- a Transmittal Letter (in duplicate) authorizing PTO to charge filing fees to Deposit Account 50-1078
- Express Mail No. EK176608187US (which corresponds to the Express Mail label No. on the Transmittal Letter of the IDS)

6. The Office affixed to the returned postcard a label containing the Application No. and filing date that was assigned to the present application. This label provides *prima facie* evidence that the Office received the IDS with the correspondence that was deposited with the United States Postal Service on March 26, 2001, in accordance with 37 CFR § 1.10(a).

For the reasons explained above, Applicants request that the Office consider the IDS attached hereto as Exhibit A as having been timely filed on March 26, 2001

Charge any excess fees or apply any credits to Deposit Account No. 50-1078.

Respectfully submitted,

Date: March 1, 2006

Edouard Garcia
Reg. No. 38,461
Telephone No.: (650) 289-0904

Please direct all correspondence to:

Avago Technologies, Inc.
c/o Klass, Law, O'Meara & Malkin, P.C.
PO Box 1920
Denver, CO 80201-1920

Applicant : Michael A. Robinson et al.
Serial No. : 09/818,433
Filed : March 26, 2001

Attorney's Docket No.: 10003782-2
Petition dated March 1, 2006

EXHIBIT A

AGILENT TECHNOLOGIES, INC.
Legal Department, 51U-PD
Intellectual Property Administration
P. O. Box 58043
Santa Clara, California 95052-8043

PATENT APPLICATION

ATTORNEY DOCKET NO. 10003782-2

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Michael A. Robinson et al

Serial No.: **Examiner:**

Filing Date: 03/26/2001 **Group Art Unit:**

Title: Fiber Optic Receiver With An Adjustable Bandwidth Post-Amplifier

COMMISSIONER FOR PATENTS
Washington, D.C. 20231

INFORMATION DISCLOSURE STATEMENT

Sir:

This Information Disclosure Statement is submitted:

(X) under 37 CFR 1.97(b), or
(Within three months of filing national application; or date of entry of national application; or before mailing date of first office action on the merits; whichever occurs last)

( ) under 37 CFR 1.97(c) together with either a:
( ) Statement under 37 CFR 1.97(e), or
( ) a $180.00 fee under 37 CFR 1.17(p), or
(After the CFR 1.97 (b) time period, but before final action or notice of allowance, whichever occurs first)

( ) under 37 CFR 1.97 (d) together with a:
( ) Statement under 37 CFR 1.97(e), and
( ) a petition under 37 CFR 1.97(d)(2), and
( ) a $130.00 petition fee set forth in 37 CFR 1.17(i).
(Filed after final action or notice of allowance, whichever occurs first, but before payment of the issue fee)

Please charge to Deposit Account 50-1078 the sum of $0.00 . At any time during the pendency of this application, please charge any fees required or credit any overpayment to Deposit Account 50-1078 pursuant to 37 CFR 1.25.

(X) Applicant(s) submit herewith Form PTO 1449 - Information Disclosure Citation together with copies, of patents, publications or other information of which applicant(s) are aware, which applicant(s) believe(s) may be material to the examination of this application and for which there may be a duty to disclose in accordance with 37 CFR 1.56.

( ) A concise explanation of the relevance of foreign language patents, foreign language publications and other foreign language information listed on PTO Form 1449, as presently understood by the individuals(s) designated in 37 CFR 1.56 (c) most knowledgeable about the content is given on the attached sheet, or where a foreign language patent is cited in a search report or other action by a foreign patent office in a counterpart foreign application, an English language version of the search report or action which indicates the degree of relevance found by the foreign office is listed on form PTO 1449 and is enclosed herewith.

It is requested that the information disclosed herein be made of record in this application.

"Express Mail" label no. EK176608187US

Date of Deposit 03/26/2001

I hereby certify that this is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to: Commissioner for Patents, Washington, D.C. 20231.

By K. Lopez Diangson

Typed Name: K. Lopez Diangson

Respectfully submitted,

Michael A. Robinson et al

By Pamela Lau Kee

Pamela Lau Kee

Attorney/Agent for Applicant(s)
Reg. No. 36,184

Date: 03/26/2001

PATENT APPLICATION

Sheet 1 of 1

FORM PTO-1449 LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT (Use several sheets if necessary)	ATTY. DOCKET NO. 10003782-2	SERIAL NO.
	APPLICANT Michael A. Robinson, et al	
	FILING DATE 03/23/2001	GROUP

REFERENCE DESIGNATION **U.S. PATENT DOCUMENTS**

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS
	1A	3,733,514	May 15,1973	Garuts		
	1B	4,124,817	Nov. 7,1978	Takahashi		
	1C	4,591,805	May 27,1986	Highton		
	1D	5,604,927	Feb.18,1997	Moore		
	1E	5,673,003	Sep. 30,1997	Zocher		
	1F	5,864,416	Jan. 26,1999	Williams		
	1G	6,118,829	Sep. 12, 2000	North		
	1H					
	1I					
	1J					
	1K					

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS	TRANSLATION YES	TRANSLATION NO
	1L							
	1M							
	1N							
	1O							
	1P							

OTHER REFERENCES (including Author, Title, Date, Pertinent Pages, etc.)

	1Q	
	1R	
	1S	

EXAMINER	DATE CONSIDERED

Applicant : Michael A. Robinson et al.
Serial No. : 09/818,433
Filed : March 26, 2001

Attorney's Docket No.: 10003782-2
Petition dated March 1, 2006

EXHIBIT B

AGILENT TECHNOLOGIES, INC.
Legal Department, 51U-PD
Intellectual Property Administration
P. O. Box 58043
Santa Clara, California 95052-8043

1

PATENT APPLICATION

ATTORNEY DOCKET NO. 10003782-2

IN THE U.S. PATENT AND TRADEMARK OFFICE
Patent Application Transmittal Letter

COMMISSIONER FOR PATENTS
Washington, D.C. 20231

EK176608187US

Sir:

Transmitted herewith for filing under 37 CFR 1.53(b) is a(n): (X) Utility ( ) Design
(X) original patent application,
( ) continuation-in-part application

INVENTOR(S): Michael A. Robinson, et al.

TITLE: Fiber Optic Receiver with an Adjustable Bandwidth Post-Amplifier

Enclosed are:

(X) The Declaration and Power of Attorney. (X) signed ( ) unsigned or partially signed

(X) 3 sheets of drawings (one set) ( ) Associate Power of Attorney

(X) Form PTO-1449 (X) Information Disclosure Statement and Form PTO-1449

( ) Priority document(s) ( )(Other) _____(fee $_____)

CLAIMS AS FILED BY OTHER THAN A SMALL ENTITY				
(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) TOTALS
TOTAL CLAIMS	12 — 20	0	X $18	$ 0
INDEPENDENT CLAIMS	1 — 3	0	X $80	$ 0
ANY MULTIPLE DEPENDENT CLAIMS	0		$270	$ 0
BASIC FEE: Design ($320.00); Utility ($710.00)				$ 710
TOTAL FILING FEE				$ 710
OTHER FEES				$
TOTAL CHARGES TO DEPOSIT ACCOUNT				$ 710

Charge $ 710 to Deposit Account 50-1078. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 50-1078 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 50-1078 under 37 CFR 1.16, 1.17,1.19, 1.20 and 1.21. A duplicate copy of this sheet is enclosed.

"Express Mail" label no. EK176608187US

Date of Deposit 03/26/2001

I hereby certify that this is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to: Commissioner for Patents, Washington, D.C. 20231.

By Katherine Lopez Diangson

Typed Name: Katherine Lopez Diangson

Respectfully submitted,

Michael A. Robinson, et al.

By Pamela Lau Kee

Pamela Lau Kee

Attorney/Agent for Applicant(s)

Reg. No. 36,184

Date: March 26,2001

Telephone No.: (408) 553-3059

AGILENT TECHNOLOGIES, INC.
Legal Department, 51U-PD
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P. O. Box 58043
Santa Clara, California 95052-8043

PATENT APPLICATION

ATTORNEY DOCKET NO. 10003782-2

IN THE U.S. PATENT AND TRADEMARK OFFICE
Patent Application Transmittal Letter

COMMISSIONER FOR PATENTS
Washington, D.C. 20231

EK176608187US

Sir:

Transmitted herewith for filing under 37 CFR 1.53(b) is a(n): (X) Utility ( ) Design
(X) original patent application,
( ) continuation-in-part application

INVENTOR(S): **Michael A. Robinson, et al.**

TITLE: **Fiber Optic Receiver with an Adjustable Bandwidth Post-Amplifier**

Enclosed are:

(X) The Declaration and Power of Attorney. (X) signed ( ) unsigned or partially signed

(X) 3 sheets of drawings (one set) ( ) Associate Power of Attorney

(X) Form PTO-1449 (X) Information Disclosure Statement and Form PTO-1449

( ) Priority document(s) ( )(Other) _____ (fee $_____)

CLAIMS AS FILED BY OTHER THAN A SMALL ENTITY				
(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) TOTALS
TOTAL CLAIMS	12 — 20	0	X $18	$ 0
INDEPENDENT CLAIMS	1 — 3	0	X $80	$ 0
ANY MULTIPLE DEPENDENT CLAIMS	0		$270	$ 0
BASIC FEE: Design ($320.00); Utility ($710.00)				$ 710
TOTAL FILING FEE				$ 710
OTHER FEES				$
TOTAL CHARGES TO DEPOSIT ACCOUNT				$ 710

Charge $ 710 to Deposit Account 50-1078. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 50-1078 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 50-1078 under 37 CFR 1.16, 1.17,1.19, 1.20 and 1.21. A duplicate copy of this sheet is enclosed.

"Express Mail" label no. EK176608187US

Date of Deposit 03/26/2001

I hereby certify that this is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to: Commissioner for Patents, Washington, D.C. 20231.

By Katherine Lopez Diangson

Typed Name: Katherine Lopez Diangson

Respectfully submitted,

Michael A. Robinson, et al.

By Pamela Lau Kee

Pamela Lau Kee

Attorney/Agent for Applicant(s)
Reg. No. 36,184

Date: March 26,2001

Telephone No.: (408) 553-3059

ATTORNEY DOCKET NO.:10003782-2

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

This is a U.S. Patent Application for:

Title: **FIBER OPTIC RECEIVER WITH AN ADJUSTABLE BANDWIDTH POST-AMPLIFIER**

Inventor #1: MICHAEL A. ROBINSON
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FIBER OPTIC RECEIVER WITH AN ADJUSTABLE BANDWIDTH POST-AMPLIFIER

TECHNICAL FIELD

This invention relates to fiber optic receivers and wideband receiver amplifiers subject to relatively tight packaging constraints.

BACKGROUND

Many advanced communication systems transmit information through a plurality of parallel optical communication channels. The optical communication channels may be defined by a fiber optic ribbon interconnect (or fiber optic cable) formed from a bundle of glass or plastic fibers, each of which is capable of transmitting data independently of the other fibers. Relative to metal wire interconnects, optical fibers have a much greater bandwidth, they are less susceptible to interference, and they are much thinner and lighter. Because of these advantageous physical and data transmission properties, efforts have been made to integrate fiber optics into computer system designs. For example, in a local area network, fiber optics may be used to connect a plurality of local computers to centralized equipment, such as servers and printers. In this arrangement, each local computer has an optical transceiver for transmitting and receiving optical information. The optical transceiver may be mounted on a substrate that supports one or more integrated circuits. Typically, each computer includes several substrates that are plugged into the sockets of a common backplane. The backplane may be active (i.e., it includes logic circuitry for performing computing functions) or it may be passive (i.e., it does not contain any logic circuitry). An external network fiber optic cable may be connected to the optical transceiver through a fiber optic connector that is coupled to the backplane.

Fiber optic transceivers typically include transmitter and receiver components. The transmitter component typically includes a laser, a lens assembly, and a circuit for driving the laser. The fiber optic receiver component typically includes a photodiode and a high gain receiver amplifier, which may be operable to perform one or more signal processing functions (e.g., automatic gain control, background current canceling, filtering or demodulation). For one-directional data transfer, a transmitter component is required at the originating end and a receiver component is required at the answering

end. For bi-directional communication, a receiver component and a transmitter component are required at both the originating end and the answering end. In some cases, the transmitter circuitry and the receiver circuitry are implemented in a single transceiver integrated circuit (IC). The transceiver IC, photodiode and laser, along with the lenses for the photodiode and the laser are contained within a package that has a size that is sufficiently small to fit within a fiber optic communication device.

SUMMARY

In one aspect, the invention features a fiber optic receiver that includes a preamplifier circuit incorporated together with an opto-electronic transducer in a receiver optical sub-assembly (ROSA), and an adjustable bandwidth post-amplifier that is located outside the ROSA to allow the overall size of the receiver package to be reduced. The ROSA is mounted on a substrate and is fitted with a fiber optic connector for coupling to a mating connector of a fiber optic cable. The opto-electronic transducer is incorporated within the ROSA and is configured to generate an electrical data signal in response to a received optical data signal. The preamplifier circuit is incorporated within the ROSA and is operable to linearly amplify an electrical data signal generated by the opto-electronic transducer. The adjustable bandwidth post-amplifier circuit is mounted on the substrate and is coupled to an output of the preamplifier circuit.

Embodiments of the invention may include one or more of the following features.

In one embodiment, the post-amplifier circuit comprises a switch for setting a bandwidth response of the post-amplifier circuit in response to a received data rate control signal. The post-amplifier circuit further comprises a low-pass filter coupled to the switch. The low-pass filter preferably comprises a capacitor.

In another embodiment, the post-amplifier circuit comprises a wide bandwidth signal path and a narrow bandwidth signal path. The post-amplifier circuit preferably further comprises a multiplexer configured to selectively present for output electrical data signals transmitted over either the wide bandwidth signal path or the narrow bandwidth signal path in response to a received data rate control signal. The wide bandwidth signal path preferably comprises an amplifier with a relatively wide

bandwidth response and the narrow bandwidth signal path preferably comprises an amplifier with a relatively narrow bandwidth response.

The post-amplifier may include an input gain buffer coupled to the output of the preamplifier circuit. The pre-amplifier circuit preferably is configured to linearly amplify an electrical data signal generated by the opto-electronic transducer over a specified range of optical data signal power. The ROSA may include a header module that is mounted on the substrate and is configured to house the opto-electronic transducer and the preamplifier. The opto-electronic transducer preferably includes a photodiode.

Among the advantages of the invention are the following.

The invention provides a fiber optic receiver that accommodates multiple data rates while conforming to existing receiver optical sub-assembly (ROSA) size and pin count constraints. In addition, the inventive placement of the adjustable bandwidth amplifier outside the ROSA enables the analog electrical data signals generated by the opto-electronic transducer to be amplified and shaped properly for data recovery, while allowing the receiver to be housed within a package sized to fit within fiber optic communication devices with significant size constraints.

Other features and advantages of the invention will become apparent from the following description, including the drawings and the claims.

DESCRIPTION OF DRAWINGS

FIG. 1 is a diagrammatic view of a fiber optic receiver, which includes an opto-electronic transducer, a preamplifier circuit and a post-amplifier circuit, and a fiber optic cable carrying an optical data signal to the fiber optic receiver.

FIG. 2A is a diagrammatic cross-sectional side view of a fiber optic cable coupled by a pair of mating connectors to a receiver optical sub-assembly (ROSA) of the fiber optic receiver of FIG. 1.

FIG. 2B is a diagrammatic cross-sectional end view of a header module of the ROSA of FIG. 2A taken along the line 2B-2B.

FIG. 3 is a circuit diagram of the post-amplifier circuit of FIG. 1.

FIG. 4 is a circuit diagram of an alternative post-amplifier circuit.

DETAILED DESCRIPTION

In the following description, like reference numbers are used to identify like elements. Furthermore, the drawings are intended to illustrate major features of exemplary embodiments in a diagrammatic manner. The drawings are not intended to depict every feature of actual embodiments or relative dimensions of the depicted elements, and are not drawn to scale.

Referring to FIG. 1, in one embodiment, a fiber optic receiver 10 includes an opto-electronic transducer 12 (e.g., a p-i-n photodiode), a preamplifier circuit 14, and an adjustable bandwidth post-amplifier circuit 16. In operation, a fiber optic cable 18 carries an optical data signal 20 to opto-electronic transducer 12. In response to optical data signal 20, opto-electronic transducer 12 generates an electrical data signal 22, which is amplified by preamplifier circuit 14. Preamplifier circuit 14 is configured to linearly amplify electrical data signal 22 over a prescribed range of optical power for optical data signal 20. The resulting pre-amplified electrical data signal 24 is further amplified by post-amplifier circuit 16, which amplifies and shapes electrical data signal 24 so that data embedded in output signal 26 may be extracted by a conventional clock and data recovery circuit.

As explained in detail below, post-amplifier circuit has an adjustable bandwidth response that may be set by a data rate control signal 28 to optimize the performance of fiber optic receiver 10 for different data rates. For example, in one embodiment, when the data rate of the received optical data signal 20 is high, the cutoff frequency of post-amplifier 16 is set high (e.g., about 1.5 GHz to about 2.5 GHz), whereas when the data rate is low, the cutoff frequency of post-amplifier circuit 16 is set low (e.g., about 0.5 GHz to about 1.5 GHz). The data rate of optical data signal 20 may be known *a priori* or may be extracted by a phase-locked loop or other techniques in the clock and data recovery circuit.

As shown in FIG. 2A, in one embodiment, fiber optic cable 18 includes a cable connector 30 that couples to a mating receiver connector 32 of fiber optic receiver 10. Cable connector 30 includes a socket 34 that is configured to slide over a protruding lip 36 of receiver connector 32. An annular sleeve 38 is disposed about the distal end of fiber optic cable 18 and is configured to slide within a channel 40 defined within receiver connector 32. Socket 34 has a pair of pins 42, 44 that are slidable within

vertical slots 46, 48 of lip 36. Socket 34 may be slid over lip 36, with pins 42, 44 aligned with slots 46, 48, until pins 42, 44 reach the ends of slots 46, 48. Socket 34 then may be rotated to seat pins 42, 44 in end extensions 50, 52 of slots 46, 48. The process of seating pins 42, 44 within end extensions 50, 52 compresses a biasing mechanism 54 (e.g., a rubber o-ring) that urges socket 34 against receiver connector 32, effectively locking cable connector 30 to receiver connector 32. When properly seated within channel 40, the one or more fibers of fiber optic cable 18 are aligned with a lens assembly 56, which focuses optical data signals 20 onto opto-electronic transducer 12.

Referring to FIG. 2B, opto-electronic transducer 12 and preamplifier circuit 14 are housed within a header module 58 of a receiver optical sub-assembly (ROSA) 60, which is mounted on a substrate 62 (e.g., a printed circuit board or other support for passive and active components) of fiber optic receiver 10. ROSA 60 and substrate 62 are contained within a receiver package 63. Opto-electronic transducer 12 is mounted centrally within ROSA 60 to receive optical data signals carried by fiber optic cable 18 that are focused by lens 56. ROSA 60 also includes a plurality of insulated posts 64, 66, 68, which define channels through which electrical connectors extend to couple substrate 62 to opto-electronic transducer 12 and preamplifier circuit 14. Because the bandwidth limiting circuitry needed to amplify and shape the analog signals received from opto-electronic transducer 12 is placed within post-amplifier circuit 16, the space within ROSA 60 that is needed to contain opto-electronic transducer 12 and preamplifier circuit 14 may be reduced and, as a result, receiver package 63 may be constructed with a relatively small size.

Referring to FIG. 3, in one embodiment, post-amplifier circuit 16 includes a positive input 70 and a negative input 72, each of which is coupled to a respective input gain buffer 74, 76. The outputs of gain buffers 74, 76 are coupled to low-pass filters 78, 80 and the inputs 82, 84 of a high gain amplifier 86, respectively. Low-pass filters 78, 80 each includes a capacitor 88, 90 and a resistor 92, 94 coupled in series. Low-pass filters 78, 80 also include respective switches 96, 98, which are configured to selectively set the bandwidth response of post-amplifier circuit 16 in accordance with the value of data rate control signal 28. In operation, when the data rate of the received optical data signal 20 is high, data rate control signal 28 is low, which opens switches

96, 98 to disconnect capacitors 88, 90 from the signal paths through post-amplifier circuit 16. As a result, the cutoff frequency of post-amplifier 16 is set high (e.g., about 1.5 GHz to about 2.5 GHz). When the data rate is low, data rate control signal 28 is set high, which closes switches 96, 98 to connect capacitors 88, 90 to the signal paths through post-amplifier circuit 16. As a result, the cutoff frequency of post-amplifier circuit 16 is set low (e.g., about 0.5 GHz to about 1.5 GHz).

Referring to FIG. 4, in another embodiment, post-amplifier circuit 16 includes a wide bandwidth signal path 100 and a narrow bandwidth signal path 102. Wide bandwidth signal path 100 includes an amplifier 104 that is characterized by a relatively high cutoff frequency (e.g., about 1.5 GHz to about 2.5 GHz) and narrow bandwidth signal path 102 includes an amplifier 106 that is characterized by a relatively low cutoff frequency (e.g., about 0.5 GHz to about 1.5 GHz). Post-amplifier circuit 16 also includes a multiplexer 108, which is configured to selectively present for output electrical data signals carried by one of wide bandwidth signal path 100 and narrow bandwidth signal path 102 in response to the value of data rate control signal 28. In particular, when the data rate of the received optical data signal 20 is high, data rate control signal 28 is high. As a result, multiplexer 108 presents for output the electrical data signals carried by wide bandwidth signal path 100. When the data rate of the received optical data signal 20 is low, data rate control signal 28 is low. As a result multiplexer 108 presents for output the electrical data signals carried by narrow bandwidth signal path 102.

Receiver 10 may be housed within a standalone receiver package or may be housed together with a transmitter component in a transceiver package.

Other embodiments are within the scope of the claims.

For example, although the above-embodiments are described in connection with a post-amplifier circuit with two different bandwidth responses, other embodiments may include post-amplifiers with more than two different bandwidth responses. Furthermore, other post-amplifiers may have a continuously variable bandwidth response, rather than a discrete variation in bandwidth response. The bandwidth response of the post-amplifier circuit also may be adjusted in different ways. For example, the bandwidth response may be adjusted by varying the bias conditions of a variable transconductance transistor in the post-amplifier circuit. Alternatively, the

bandwidth response may be adjusted by varying the bias voltage applied to a varactor (voltage-variable capacitor) in the post-amplifier circuit. In addition, instead of varying capacitance values as in the above-described embodiments, the resistance values in the low-pass filters coupled to the signal paths through the post-amplifier circuit may be varied. The bandwidth response alternatively may be adjusted by varying the gain of an amplifier within the post-amplifier circuit.

Other embodiments may use fiber optic connectors that are different from the bayonet-type connectors 30, 32 to couple fiber optic cable 18 to receiver 10.

WHAT IS CLAIMED IS:

1. A fiber optic receiver, comprising:

a substrate;

a receiver optical sub-assembly (ROSA) mounted on the substrate and comprising a fiber optic connector for coupling to a mating connector of a fiber optic cable;

an opto-electronic transducer incorporated within the ROSA and configured to generate an electrical data signal in response to a received optical data signal;

a preamplifier circuit incorporated within the ROSA, coupled to the opto-electronic transducer, and operable to linearly amplify an electrical data signal generated by the opto-electronic transducer; and

an adjustable bandwidth post-amplifier circuit mounted on the substrate and coupled to an output of the preamplifier circuit.

2. The fiber optic receiver of claim 1, wherein the post-amplifier circuit comprises a switch for setting a bandwidth response of the post-amplifier circuit in response to a received data rate control signal.

3. The fiber optic receiver from claim 2, wherein the post-amplifier circuit further comprises a low-pass filter coupled to the switch.

4. The fiber optic receiver of claim 3, wherein the low-pass filter comprises a capacitor.

5. The fiber optic receiver of claim 1, wherein the post-amplifier circuit comprises a voltage-variable capacitor.

6. The fiber optic receiver of claim 1, wherein the post-amplifier circuit comprises a wide bandwidth signal path and a narrow bandwidth signal path.

7. The fiber optic receiver of claim 6, wherein the post-amplifier circuit further comprises a multiplexer configured to selectively present for output electrical data signals transmitted over one of the wide bandwidth signal path and the narrow bandwidth signal path in response to a received data rate control signal.

8. The fiber optic receiver of claim 6, wherein the wide bandwidth signal path comprises an amplifier with a relatively wide bandwidth response and the narrow bandwidth signal path comprises an amplifier with a relatively narrow bandwidth response.

9. The fiber optic receiver of claim 1, wherein the post-amplifier comprises an input gain buffer coupled to the output of the preamplifier circuit.

10. The fiber optic receiver of claim 1, wherein the pre-amplifier circuit is configured to linearly amplify an electrical data signal generated by the opto-electronic transducer over a specified range of optical data signal power.

11. The fiber optic receiver of claim 1, wherein the ROSA comprises a header module mounted on the substrate and configured to house the opto-electronic transducer and the preamplifier.

12. The fiber optic receiver of claim 1, wherein the opto-electronic transducer comprises a photodiode.

FIBER OPTIC RECEIVER WITH AN ADJUSTABLE BANDWIDTH POST-AMPLIFIER

ABSTRACT

In one aspect, the invention features a fiber optic receiver that includes a preamplifier circuit incorporated together with an opto-electronic transducer in a receiver optical sub-assembly (ROSA), and an adjustable bandwidth post-amplifier that is located outside the ROSA to allow the overall size of the receiver package to be reduced. The ROSA is mounted on a substrate and is fitted with a fiber optic connector for coupling to a mating connector of a fiber optic cable. The opto-electronic transducer is incorporated within the ROSA and is configured to generate an electrical data signal in response to a received optical data signal. The preamplifier circuit is incorporated within the ROSA and is operable to linearly amplify an electrical data signal generated by the opto-electronic transducer. The adjustable bandwidth post-amplifier circuit is mounted on the substrate and is coupled to an output of the preamplifier circuit.

1/3

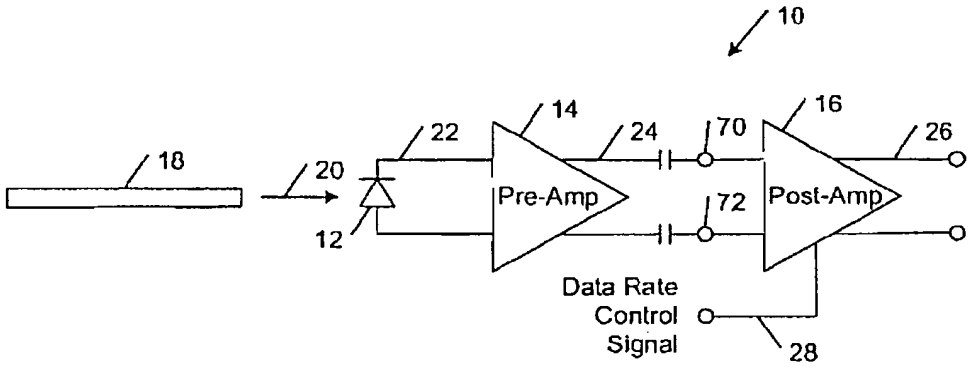

FIG. 1

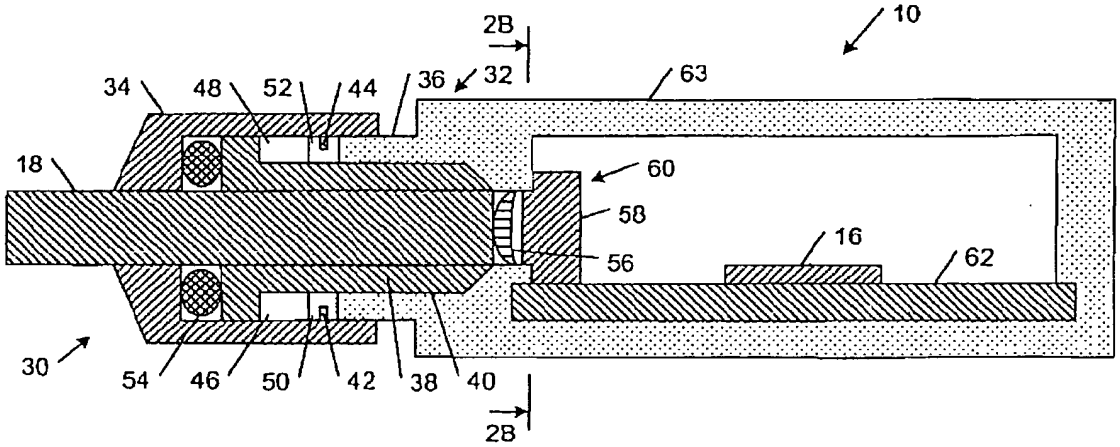

FIG. 2A

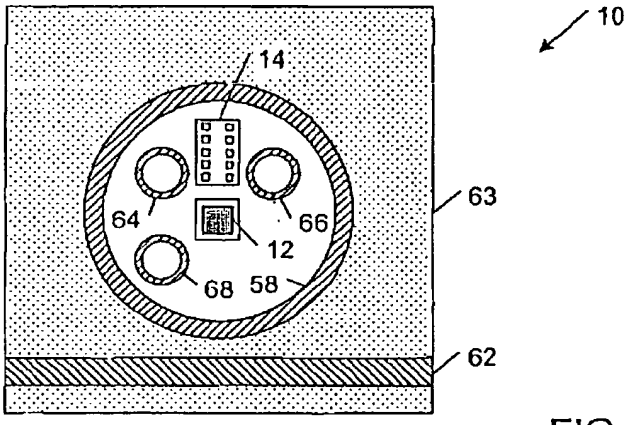
10
14
63
64
66
12
68
58
62

FIG. 2B

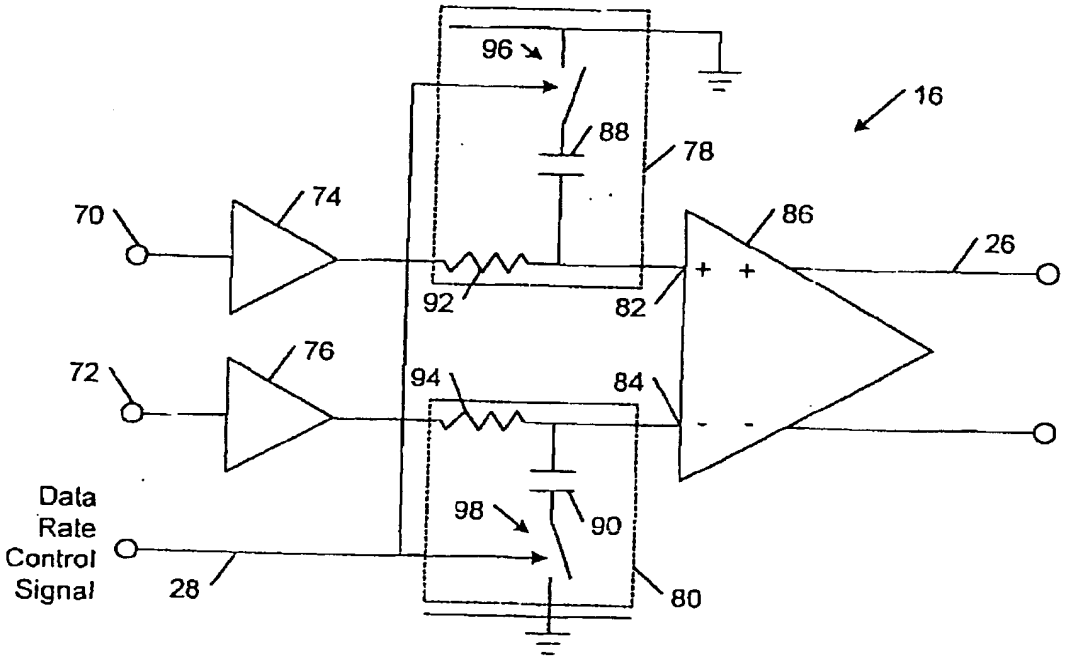
96
16
88
78
70
74
86
26
92
82
72
76
94
84
Data
Rate
Control
Signal
98
90
28
80

FIG. 3

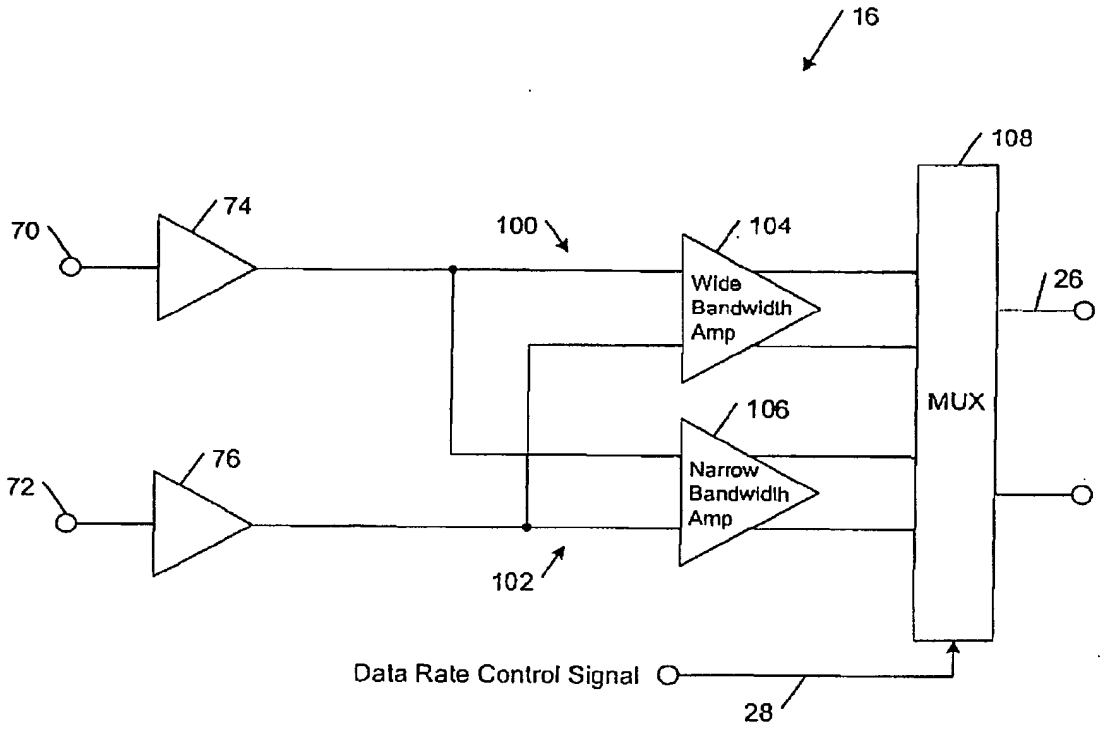
16
108
70
74
100
104
Wide
Bandwidth
Amp
26
MUX
106
Narrow
Bandwidth
Amp
72
76
102
Data Rate Control Signal
28

FIG. 4

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PATENT APPLICATION

ATTORNEY DOCKET NO. 10003782-2

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Michael A. Robinson et al

Serial No.: **Examiner:**

Filing Date: 03/26/2001 **Group Art Unit:**

Title: Fiber Optic Receiver With An Adjustable Bandwidth Post-Amplifier

COMMISSIONER FOR PATENTS
Washington, D.C. 20231

INFORMATION DISCLOSURE STATEMENT

Sir:

This Information Disclosure Statement is submitted:

(X) under 37 CFR 1.97(b), or
(Within three months of filing national application; or date of entry of national application; or before mailing date of first office action on the merits; whichever occurs last)

( ) under 37 CFR 1.97(c) together with either a:
( ) Statement under 37 CFR 1.97(e), or
( ) a $180.00 fee under 37 CFR 1.17(p), or
(After the CFR 1.97 (b) time period, but before final action or notice of allowance, whichever occurs first)

( ) under 37 CFR 1.97 (d) together with a:
( ) Statement under 37 CFR 1.97(e), and
( ) a petition under 37 CFR 1.97(d)(2), and
( ) a $130.00 petition fee set forth in 37 CFR 1.17(i).
(Filed after final action or notice of allowance, whichever occurs first, but before payment of the issue fee)

Please charge to Deposit Account **50-1078** the sum of $0.00 . At any time during the pendency of this application, please charge any fees required or credit any overpayment to Deposit Account **50-1078** pursuant to 37 CFR 1.25.

(X) Applicant(s) submit herewith Form PTO 1449 - Information Disclosure Citation together with copies, of patents, publications or other information of which applicant(s) are aware, which applicant(s) believe(s) may be material to the examination of this application and for which there may be a duty to disclose in accordance with 37 CFR 1.56.

( ) A concise explanation of the relevance of foreign language patents, foreign language publications and other foreign language information listed on PTO Form 1449, as presently understood by the individuals(s) designated in 37 CFR 1.56 (c) most knowledgeable about the content is given on the attached sheet, or where a foreign language patent is cited in a search report or other action by a foreign patent office in a counterpart foreign application, an English language version of the search report or action which indicates the degree of relevance found by the foreign office is listed on form PTO 1449 and is enclosed herewith.

It is requested that the information disclosed herein be made of record in this application.

"Express Mail" label no. EK176608187US

Date of Deposit 03/26/2001

I hereby certify that this is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to: Commissioner for Patents, Washington, D.C. 20231.

By K. Lopez Diangson

Typed Name: K. Lopez Diangson

Respectfully submitted,

Michael A. Robinson et al

By Pamela Lau Kee

Pamela Lau Kee

Attorney/Agent for Applicant(s)
Reg. No. 36,184

Date: 03/26/2001

PATENT APPLICATION
Sheet 1 of 1

FORM PTO-1449	ATTY. DOCKET NO.	SERIAL NO.
LIST OF PATENTS AND PUBLICATIONS FOR APPLICANT'S INFORMATION DISCLOSURE STATEMENT	10003782-2	
	APPLICANT: Michael A. Robinson, et al	
(Use several sheets if necessary)	FILING DATE: 03/23/2001	GROUP

REFERENCE DESIGNATION **U.S. PATENT DOCUMENTS**

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS
	1A	3,733,514	May 15,1973	Garuts		
	1B	4,124,817	Nov. 7,1978	Takahashi		
	1C	4,591,805	May 27,1986	Highton		
	1D	5,604,927	Feb.18,1997	Moore		
	1E	5,673,003	Sep. 30,1997	Zocher		
	1F	5,864,416	Jan. 26,1999	Williams		
	1G	6,118,829	Sep. 12, 2000	North		
	1H					
	1I					
	1J					
	1K					

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	NAME	CLASS	SUB CLASS	TRANSLATION YES	TRANSLATION NO
	1L							
	1M							
	1N							
	1O							
	1P							

OTHER REFERENCES (including Author, Title, Date, Pertinent Pages, etc.)

	1Q	
	1R	
	1S	

EXAMINER DATE CONSIDERED

U 06118829A

United States atent [19] 19
North

[11] Patent Number: 6,118,829
[45] Date of Patent: Sep. 12, 2000

[54] APPARATUS AND METHOD FOR IBM Microelectronics "Infrared Transceiver Module

US005864416A

United States Patent [19]
Williams

[11] Patent Number: 5,864,416
[45] Date of Patent: Jan. 26, 1999

[54] TUNING OPTICAL COMMUNICATIONS RECEIVER BY CONTROLLING DRAIN

Primary Examiner—Edward Lefkowitz

US005673003A

United States Patent [19]
Zocher

[11] Patent Number: 5,673,003
[45] Date of Patent: Sep. 30, 1997

[54] AMPLIFIER CIRCUIT HAVING A VARIABLE BANDWIDTH

5,266,852 11/1993 Shingemari et al. .
5,293,087 3/1994 Hamano et al. .

US005604927A

United States Patent [19]
Moore

[11] Patent Number: 5,604,927
[45] Date of Patent: Feb. 18, 1997

United States Patent [19]
Highton

[11] Patent Number: 4,591,805
[45] Date of Patent: May 27, 1986

[54] ADAPTIVE BANDWIDTH AMPLIFIER

FOREIGN PATENT DOCUMENTS

United States Patent [19]
Takahashi

[11] 4,124,817
[45] Nov. 7, 1978

[54] BANDWIDTH SWITCHING CIRCUIT FOR

United States Patent [19]
Garuts

[11] 3,733,514
[45] May 15, 1973

[54] WIDE BAND AMPLIFIER HAVING

[57] ABSTRACT

Applicant : Michael A. Robinson et al.
Serial No. : 09/818,433
Filed : March 26, 2001

Attorney's Docket No.: 10003782-2
Petition dated March 1, 2006

EXHIBIT C

Dear Sir:

Please acknowledge receipt of the following document(s)
re U.S. Patent Application No. **10003782-2** Atty: PLK

Inventors: **Michael Robinson, et al.**

Title: **Fiber Optic Receiver with an Adjustable Bandwidth Post-Amplifier**

1	IDS with 7 References
11	Pages of specification, claims, & abstract
12	Claims (total #)
3	Three (3) Sheets of Drawings
X	Declaration and Power of Attorney (*signed*)
X	Transmittal Letter *(in duplicate)* authorizing PTO to charge filing fees to Deposit Account 50-1078
X	Express Mail No. **EK176608187US** dated **03/26/2001**